THORACOPLASTY—SURGERY OF PULMONARY TUBERCULOSIS*

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AND
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DISCUSSION *by Henry Hoit, M.D., La Vina; Leo Eloesser, M.D., San Francisco; Lewis D. Remington, M.D., Monrovia.*

PART I

MEDICAL ASPECTS, BY A. D. ELLSWORTH

SINCE thoracoplasty is a comparatively new procedure the reporting of even a small series of cases may help to throw light on its value.

The chief drawback of artificial pneumothorax has been that it can be used in only a small percentage of cases. In searching for means to overcome this difficulty, various operative procedures have been developed by surgeons; of these paravertebral thoracoplasty seems to be the most successful.

Statistics as to the frequency with which lung collapse is applicable are apt to be misleading, because they are usually based on selected cases. Unilateral disease, and cases free from adhesions, will be more common in institutions where only early cases are admitted.

Therefore it may be of interest to consider the statistics of a hospital where nearly all cases are advanced or far advanced. During a certain period, 222 patients were admitted. Of these, only sixteen were found for whom pneumothorax could be recommended. In three others, pneumothorax was done for intractable hemorrhage, making nineteen cases, or 8.5 per cent for both optional and compulsory pneumothorax. Four refused operation. In five pneumothorax failed on account of adhesions. In nine it was successful. Thus it was found possible to do pneumothorax in 50 per cent of the suitable cases, or in 4 per cent of the number of patients admitted.

Six patients, including all of the five in whom pneumothorax failed, submitted to thoracoplasty, and the promptness with which improvement followed seemed almost incredible. The plan of operation followed was that recommended by Alexander, namely, a preliminary phrenicotomy, followed by a thoracoplasty in two stages. The operative technique will be discussed by Doctor Pettis, who deserves the credit for that part of the work.

On account of the supposed dangers of this operation it has generally been regarded as a last resort. I believe that this attitude will change as our experience increases, and that we may come to offer this chance of recovery to those who have earlier lesions which continue to be active in spite of the rest cure. By waiting too long we have poorer surgical risks.

OPERATIVE INDICATIONS

Given a patient with predominantly unilateral disease, the result of rest and diet is at first determined. If fever and loss of weight continue it may be assumed that the disease will remain active and that the prognosis warrants more active interference. Pneumothorax is then attempted. If after a sufficient number of trials it is found not possible to enter the pleural space, or that only a pocket is formed, then pneumothorax must be abandoned.

These preliminary steps have been carried out in each of the cases reported.

While this operation must be limited to those whose disease is predominantly one-sided, it is not necessary that the better lung should show an absolutely clear film. In these last resort cases the removal of the greater source of toxemia and fever in one lung gives the patient a chance to cope with the disease in the better lung. The fear that increased respiratory movement in the better lung would lead to activation of the disease has not proved to be well founded. As a matter of fact all of these patients had the respiratory function practically limited to one lung before operation was considered. The cases to be reported were patients who were inevitably approaching death from tuberculosis. It is a great satisfaction to find a surgical means of completely reversing this hopeless prognosis or of relieving distressing symptoms.

CASE REPORTS

CASE 1—M. M., a Mexican woman, age 31 years, was admitted in June, 1925. She had been coughing for a year and a half, and had had two hemorrhages. Sputum was positive. During thirteen weeks following her admission to the hospital, while at rest in bed, she continued to have a temperature of from 101 to 104; her weight during this period remained stationary (Charts 1-3). Phrenicotomy on November 6, 1925, was followed by slight improvement in temperature and weight. Thoracoplasty was unavoidably delayed for ten weeks, during which time she gained eight pounds. Five days after the first stage her temperature was normal, and during the next thirty days until the second stage it went above normal once, and then only to 99. Following the second stage she rarely had fever until her discharge in September, 1925. At this

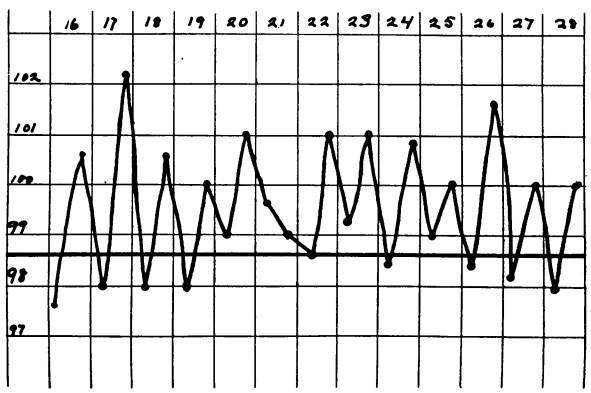

Chart 1—Showing the temperature range prior to operation in Case 1

* Read before the General Surgery Section of the California Medical Association at the Fifty-Sixth Annual Session, April 25-28, 1927.

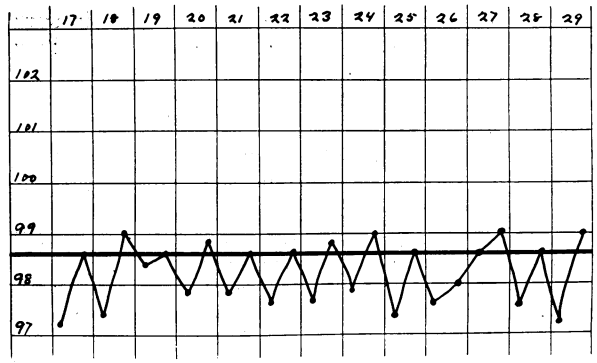

Chart 2—Showing the temperature range in Case 1 one year later

time she had gained forty-one pounds in weight, had no cough, her sputum was negative, and she had the appearance of a well woman.

One point is of especial interest. At the time of her admission the right or better lung was not free from lesions, as shown by x-ray and physical examination. With the reduction of temperature and improvement in nutrition, there was a marked improvement in the right lung, so that the x-ray report, one month before her discharge, reads, "Right lung field clear."

CASE 2—F. B., male, Mexican, age 53 years, entered the hospital in January, 1926, in a very weak and emaciated condition, with high fever. As he was unable to stand, we do not know his weight at that time. The left lung was completely consolidated, with cavitation, but the right lung remained comparatively normal. Phrenicotomy produced no change in the diaphragm nor in his general condition. Thoracoplasty in two stages was performed on March 19 and April 16, 1926. Two ribs showed considerable tuberculous necrosis, but this did not interfere with primary healing of the wound.

There was immediate improvement in his temperature curve and general condition. When able to stand on the scales, five weeks after the operation, he lacked only nine pounds of equaling his previous maximum of 141 pounds. At the time of his discharge in October, 1926, he weighed 159, or eighteen pounds more than his previous maximum. He had very little cough, no sputum, appeared perfectly well, and there was no evidence of disease in the right lung.

CASE 3—M. S., an American woman, age 23 years, had been coughing and losing weight for five years, following a pneumonia. There was irregular fever to 101. Tubercle bacilli were present. Even with absolute rest in bed she continued to lose until her weight reached ninety-four pounds. At the time of admission there was only a small lesion in the left

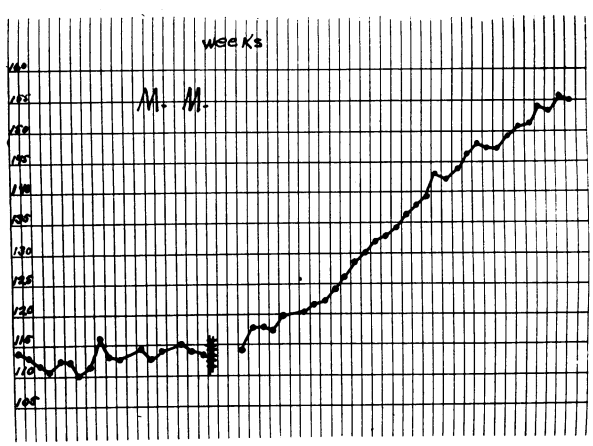

Chart 3—Showing weight range in Case 1

apex, but it advanced with great rapidity until the whole lung was consolidated. Although this was not the type of case for which surgery would ordinarily be considered, we felt that interference was warranted, for if the other lung became involved the progress there would be equally rapid, and the outlook hopeless.

In this case both pneumothorax and phrenicotomy failed because there was no retraction of the consolidated lung. Two-stage thoracoplasty was done on March 12 and April 9, 1926. Her weight then increased, but not so markedly as in the other cases. There was, however, a decided improvement in her appearance and general condition. When discharged in September, 1926, there was no cough, and no sputum could be obtained. She had gained ten pounds. Four months after her discharge she was running a practically normal temperature, and her pulse ranged from 72 to 80.

One year after her discharge she continues to have a normal temperature and pulse, and there is no evidence of disease in the right lung although there has been no further gain in weight.

CASE 4—L. N., American, male, age 24 years, was admitted in June, 1925. During the fifteen months from his admission to the date of operation he had continuous hectic fever reaching 101, 102, or 103, with a chill almost every morning. Many bacilli were present. While there was bilateral involvement, the right lung seemed rather to improve as the disease advanced in the left, so that at the time of opera-

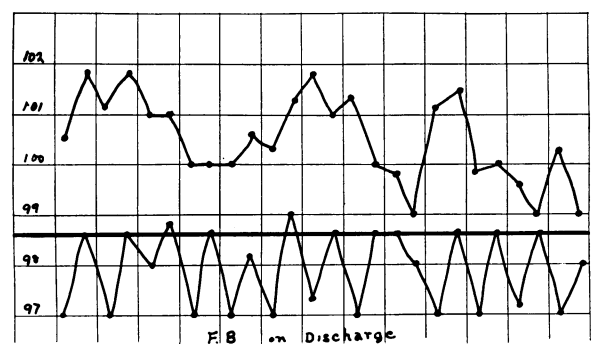

Chart 4—Showing temperature range in Case 2, on admission and on discharge

tion there was a great difference in the condition of the two lungs. But it was not a unilateral case, and the operation was distinctly a last resort. Thoracoplasty was done in two stages on September 21 and October 19, 1926. Following the operation the temperature rose to 103, but was normal on the fourth day, and during the next two months was above normal on only a few occasions, the highest point being 99.2 His general condition is markedly improved, though there is still some cough and expectoration. While with continuous bed rest this patient had lost twenty-eight pounds, following thoracoplasty, he regained six pounds in the first four weeks. Six months after operation he had a normal temperature and pulse and has continued to gain in weight. Although this operation was distinctly a last resort, the result up to this time has been very satisfactory and, we feel, has amply justified the undertaking.

One year after operation this patient continues to have a normal temperature and pulse, weighs more than his previous maximum, and the x-ray shows gradual improvement in the better lung.

CASE 5—Mrs. C, American, was admitted in July, 1925. There was far-advanced disease of the left lung, with extensive cavitation. During a year and a half, under complete rest, the disease remained active. Thoracoplasty was done in December, 1926 and January, 1927. It is too soon to make any report as to the result of operation, but her progress to date

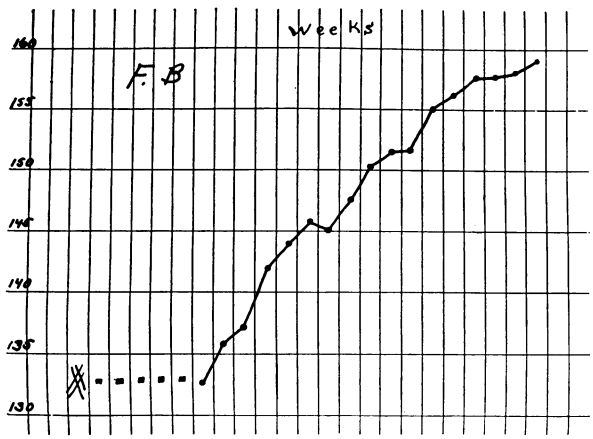

Chart 5—Showing the weight range in Case 2

has been very satisfactory, and the fact that she has, over so long a period, shown such marked resistance to any advance of the tuberculous process in the right lung leads us to hope that the final result may be satisfactory.

Nine months after operation this patient has only occasional slight fever, has begun to gain in weight, and there is distinct improvement in her appearance.

CASE 6—L. W., American, male, had had artificial pneumothorax on the left side two years before, with marked improvement. However, he had stopped treatment and allowed the lung to re-expand, and, as is usual, it was impossible to begin pneumothorax again. He had also a beginning laryngeal tuberculosis. As the result seemed hopeless without interference, thoracoplasty was done in two stages in April, 1927. There is a decided improvement in temperature and general appearance, but the final result cannot be predicted at this time.

Six months after operation the patient's condition is the same, or slightly worse, than before operation.

CONCLUSIONS

Pneumothorax is recognized as a very beneficial procedure in suitable cases. For the rather large percentage of such cases where it cannot be done, thoracoplasty offers a mean of accomplishing the same result.

While the above series of cases is small, the results were so uniformly good, and the pain and shock so negligible, that this operation would seem advisable in certain cases in which the disease is actively advancing, but has not yet reached a stage making this a last resort.

Operative and postoperative mortality have been nil. Shock and pain, during and following the operation have been slight.

Improvement in temperature, weight and general condition was very prompt, and this continued in the first three cases until they appeared well when discharged. The other three cases have been too recent to justify comment.

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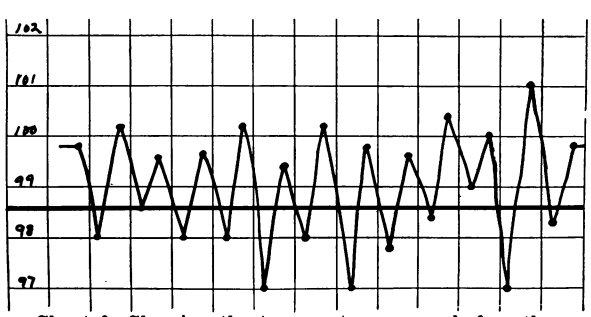

Chart 6—Showing the temperature range before the second-stage operation in Case 3

PART II

SURGICAL ASPECTS, BY JOHN H. PETTIS

One of the most noteworthy publications in the field of surgery in recent years is "The Surgery of Pulmonary Tuberculosis" by John Alexander. This volume came from the press in 1925, and is the first book on this subject in the English language. In the author's preface Alexander calls attention to the fact that "few physicians and surgeons are as yet aware that surgery is now curing or improving approximately two-thirds of those selected cases of far-advanced pulmonary tuberculosis that other methods of treatment have failed to benefit." Likewise, Hugh Cabot in the introduction states, "American surgeons have been

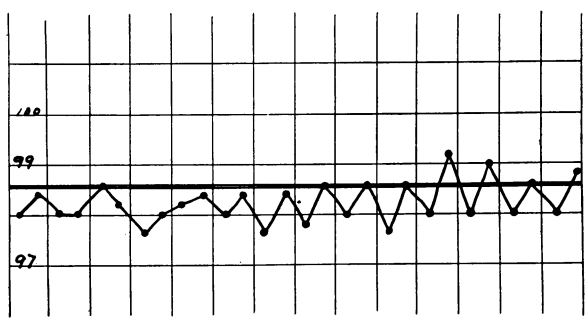

Chart 7—Showing the temperature range three weeks after the second-stage operation in Case 3

notoriously backward in doing pioneer work in the surgery of pulmonary tuberculosis. For more than a generation operative surgery in this field has been developing, chiefly on the continent. Yet very little attention has been paid to it in this country." The chief aim of Alexander's volume is, therefore, "to acquaint the medical profession with the principles and practical details that will enable it each year to save thousands of lives which certainly will be lost if surgery is not undertaken."

My interest was first attracted to this field of surgery in 1925, soon after the publication of Alexander's book. At that time the reported number of cases treated surgically during the preceding seven years in the United States was approximately three hundred. These three hundred cases had been operated by seventeen surgeons. At the present time authorities estimate that there are about thirty thousand persons in the United States with pulmonary tuberculosis who present suitable indications for surgical treatment and who will die of their tuberculosis if no operation is per-

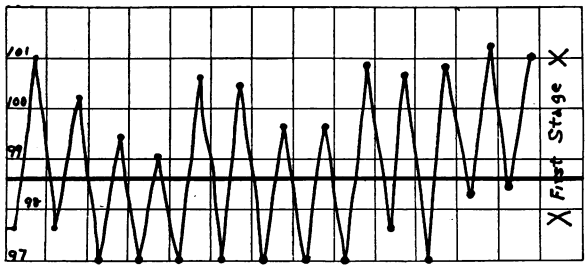

Chart 8—Showing the temperature range in Case 4 prior to operation

formed. Since the appearance of Alexander's work in 1925 the number of thoracoplasties has greatly increased. The operation is now being performed by a large number of surgeons in all parts of the United States. However, the reports of cases in the literature are relatively few, most of them coming from specialists in chest surgery working in the large clinics.

It is not the object of this paper to discuss the conditions that constitute suitable indications for surgical treatment, nor to outline the principles involved in selecting cases for operation. Doctor Ellsworth in Part I of this paper has dealt with this phase of the problem. There is general agreement that the task of discovering possible suitable cases belongs to the tuberculosis specialist, and that the final selection of cases for operation is the outgrowth of consultation between this specialist, the roentgenologist, and the surgeon. The technique of the operation has been splendidly described and illustrated by Alexander, Lilienthal, and others. My purpose in this paper on the surgery of pulmonary tuberculosis is to give some account of the experiences of a general surgeon who does not profess to be highly specialized in chest surgery.

TECHNIQUE USED IN PATIENTS OPERATED

My experience in the surgical treatment of pulmonary tuberculosis is limited to six patients, all from the tuberculosis ward at the General Hospital of Fresno County. These patients were selected as suitable for operation by Doctor Ellsworth, in consultation with the roentgenologist and myself.

Each patient was treated by a preliminary simple phrenicotomy and a two-stage extrapleural paravertebral thoracoplasty. The interval between the phrenicotomy and the first stage of the thoracoplasty varied from a few days to several weeks. The second stage of the thoracoplasty followed the first in from four to five weeks. In two cases the upper seven ribs were resected at the first operation and ribs eight to eleven inclusive resected at the second. In the other four patients, ribs six to eleven were resected first and the upper five ribs removed at the second stage.

Chart 9—Showing the temperature range one week after second-stage operation in Case 4

The lengths of ribs resected was as follows: One to two centimeters from the first rib, five to six from the second, five to nine from the third, five to ten from the fourth, seven to ten from the fifth, eight to eleven from the sixth and seventh, ten to fourteen from the eighth, nine to twelve from the ninth and tenth, and eight to ten from the eleventh. It has been shown by Eloesser and others that quite as good lung compression results when shorter lengths of each rib are resected. This is especially true of the lower ribs. It is therefore probable that in this series a more radical removal of the rib cage has been done than is necessary or even advisable.

Whether or not simple phrenicotomy as a preliminary measure is of value is to my mind undetermined. Simple section of the nerve is a slight operation easily performed in a few minutes under

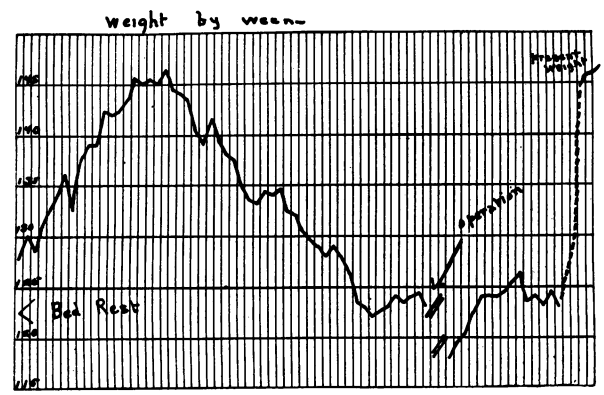

Chart 10—Showing the weight range in Case 4

local anesthesia. In three patients this simple procedure resulted in a marked ascent of the diaphragm; in the other three, there was only a slight elevation. This partial failure in three cases may have been due to dense adhesions between the diaphragm and the lung. Possibly a radical phrenicotomy might have given more uniform results.

The thoracoplasty was in each case performed under local anesthesia according to the technique described by Alexander. The solution used was one per cent novocain to one hundred cubic centimeters of which was added 1 cc. of 1 to 2600 suprarenin. None of the patients complained of pain during the operation, the only discomfort seeming to be the cramped position on the operating table. In no case was section of the intercostal nerve or its injection with alcohol resorted to. For the first twenty-four hours following the operation postoperative pain was such as to require moderate doses of morphin every four

hours, but after that interval there was no complaint. In no patient was there more than moderate shock following either stage of the thoracoplasty nor was there great cardiac embarrassment in any case, though all six patients were left-sided. There was slight wound infection in one patient.

COMMENT

Six patients are too few from which to make convincing deductions. However, it is interesting to note, first, that these desperately ill individuals were able to withstand these rather formidable procedures; second, that they all decidedly improved in that the cough disappeared or was alleviated, sputum decreased, temperature returned promptly to normal, and weight increased markedly in three patients, moderately in the other three. Three of the patients have left the hospital and have resumed some kind of work. Three patients are still in the hospital under observation. One patient is almost ready for discharge. The other two have shown marked clinical improvement, but have been operated too recently to justify any prognosis as to their final outcome.

What the late results will be in any of these patients cannot be foretold at this time. However, I feel that even though the results prove to be only temporary the surgical measures were amply justified.

CONCLUSIONS

From these limited experiences in this comparatively new field, may I offer for your consideration the following conclusions:

1. That the selection of cases suitable for surgical treatment should be the duty of the tuberculosis specialist, in consultation with the roentgenologist and the surgeon.

2. Many cases needing operation will be neglected unless general surgeons concern themselves with this problem.

3. The technical details of this operation can be mastered by a well-trained general surgeon.

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DISCUSSION

HENRY HOIT, M. D. (La Vina)—From a very limited experience in the practice of the principle of functional rest, surgically induced, in the treatment of pulmonary tuberculosis, I would regard the chief objection to artificial pneumothorax to be, not its restricted applicability, but its apparent unreliability. It does not accomplish the kind of relief which lasts in this most serious malady. It does not continue indefinitely the effects which are the most conducive to the welfare of the individual irrespective of his cooperation. It may produce at first, and very often it does produce, a change for the better which is quite remarkable, but too often the change is transient, due to the inconstancy of its action. For the sake of a result which is satisfying, it must be pursued faithfully over an extended period of time. In the presence of two common conditions—fibrous pleurisy and vomica—it is quite apt to fail.

Multiple costectomy, on the other hand, is much more reliable. It offers, at no great risk, not only more certain healing of the lung, but also protection of it against active disease for the rest of the life of the patient. As time passes, pneumothorax exerts a less dramatic and favorable influence, whereas thoracoplasty exerts a slowly accumulating and beneficial influence. Other things being equal and allowed for, multiple costectomy should not be postponed in advanced cases in the presence of fibrous pleurisy or cavitation. Both of these complications tend to affect the outcome adversely and the sooner surgical aid is extended to a patient so unfortunate the better the result is likely to be.

The point mentioned concerning the effect of interference upon the contralateral lung—that because it must do more work it will therefore become more susceptible to an active process—is a good one. To be influenced by this to withhold a surgical hand may mean failure to many a patient who might make good.

Multiple costectomy carried on conservatively is the operation of choice in the management of phthisis. In the event of recovery the reduction in the volume of the thorax so produced, if it is commensurate with the amount of lung tissue destroyed, leaves a space more nearly natural for the healthy lung to function in most advantageously. Furthermore, it may save the mediastinal structures—the heart, vessels, and tubes—from embarrassment due to the displacement occurring in the process of healing.

As we come to view the individual and his reaction to the infection rather than the apparent involvement of his lungs, I think that we will be influenced to practice the principle of functional rest by means of surgery instead of bed rest. We lack the courage of our convictions and are prone to regard too much the opinion of others as we study our patients and their needs.

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LEO ELOESSER, M. D. (490 Post Street, San Francisco)—The patients of Doctors Ellsworth and Pettis were well chosen; all of them were ideal subjects for thoracoplasty, and their results are proportionately good. If there is any point with which I should be inclined to take issue with Doctor Ellsworth it would be his statement that "on account of the supposed dangers of the operation it has generally been regarded as a last resort." I think it still should be so regarded, for its dangers are not supposed, but very real; not the danger of immediate operative death—for that is slight—but the danger of setting one lung totally and permanently out of commission. That is something that one is very reluctant to do, as long as portions of the affected lung are sound; for should the remaining lung become actively tuberculous the patient is irrevocably lost, and this danger is very real. Until we know a good deal more about the postoperative mortality in thoracoplasty, not the immediate mortality but the mortality ten or more years after operation, I hesitate to advise it in early tuberculosis, and until all other means have been exhausted; although I agree that the operation is justifiable without prolonged attempt at conservative treatment in patients with large cavities or diffuse fibrous unilateral involvement. In the hope of saving some unaffected part of the lung I have recently operated upon a dozen patients by partial thoracoplasty. The results remain to be seen.

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LEWIS D. REMINGTON, M. D. (146 North Primrose Avenue, Monrovia)—We have often been told that tuberculosis is one of the most curable of diseases. Also that to secure the healing of the lung it is necessary that the stresses against which the body is struggling must, so far as possible, be removed.

Thoracoplasty is one of the ways by which, in some instances, this can be done. Physicians differ as to what they consider the suitable cases.

One says that it should be used only in extensive involvement of the left lung; where a large cavity or multiple cavities exist; where already the heart is embarrassed, as the support on the left side is weakened.

Another goes to the other extreme and says that thoracoplasty should be considered in every case in

which a cavity of the size of a hickory nut exists in either lung; where bed rest and intelligent care for six months have failed to bring about improvement; and where pneumothorax has been tried and has proved unsuccessful because of adhesions.

Whatever position we take we are beginning to realize its great value in the treatment of tuberculosis. Physicians are keeping the method in mind when studying the progress of their patients, rather than leaving it to be considered after all other means have failed.

PHLEBOLITHS*

By JAMES R. DILLON, M. D.
AND
BERNARD A. CODY, M. D.
San Francisco

DISCUSSION *by H. A. Rosenkranz, M. D., Los Angeles; Robert V. Day, M. D., Los Angeles; W. P. Willard, M. D., San Francisco; R. L. Rigdon, M. D., San Francisco.*

PHLEBOLITHS have been recognized by pathologists and anatomists for many years as realities, but not until the advent of the x-ray did they become of clinical interest. Rokitansky described phleboliths from an anatomic standpoint in 1856, as occurring most frequently in the periprostatic plexus in males and in the pampiniform plexus in females. The early investigators noted small round shadows in their roentgenograms of the pelvis which they could not satisfactorily explain, and the failure of surgeons always to find supposed ureteral stones led Tuffier in 1897, and Kolisher and Schmidt in 1901, to use a shadow-casting ureteral stilette for facilitating the diagnosis of ureteral and renal diseases. That phleboliths themselves cast shadows was not proven until 1908 by Clark and Orton, working independently. With the improved cystoscopic technique, the use of shadow-casting fluids to obtain pyelograms and ureterograms, and the use of the stereo, the diagnosis of them has become very accurate and rendered them important, especially to the roentgenologists and urologists. They are also of clinical importance to the surgeon and internist in that their shadows should indicate the necessity of a complete urological and cystoscopic examination if renal and ureteral disease is suggested.

RECENT LITERATURE

A recent report by Culligan in looking over 1555 consecutive roentgenograms of the pelvis at the Mayo Clinic, showed phleboliths in 38.99 per cent. The average age was 37.03 years, youngest 16: 59.2 per cent males and 40.8 per cent females. He stated they were found in the veins of the perivesical and periprostatic plexuses in males and in the perivesical and uterine plexuses in females, also occasionally in the veins of the spleen.

Culligan states a phlebolith grows from a central nucleus which arises in a thrombus. He also quoted Pulford that phleboliths occur in 2 per cent of hemangiomas, which could indicate that stasis can be a factor in their formation without infection. The relatively greater frequency of phleboliths in males gives infection a rôle, because of the frequent specific and nonspecific infection of the prostatic ducts supplying secondary infection to the adjacent plexus of dilated tortuous veins where stasis already exists, resulting in the formation of thrombi, which later calcify as a healing process. The absence of muscular support around these veins favors stasis and may help to produce thrombi. Thrombi in other parts of the body are probably better nourished and continue to exist as thrombi, while healing and calcification occur if the thrombi are undernourished. The chief factors in the formation of phleboliths are therefore lack of muscular support to the veins, stasis, undernourishment and healing by calcification.

Gynecologists have recognized for years the symptoms arising from varicose ovarian veins, and Clark in 1902 described relieving a woman of pelvic pain by cutting and ligating the ovarian veins, after tracing them into the pelvis and finding them enormously distended and containing five small phleboliths, lying encapsulated in the veins. He did not remove the phleboliths. In general, to date phleboliths have been treated as inert and symptomless incidentals. The frequent occurrence of patients complaining of pains in the lower abdomen, pelvis and hips, with no logical explanation of the symptoms, but with shadows of large and frequently multiple phleboliths in the region of the symptoms, caused us to doubt their innocence in all cases, and to start an investigation to determine the possibility of symptoms coming from them. The reports of various authors fairly definitely establish the fact that the presence of phleboliths indicates varicosities. If varicosities can cause pain in the legs and testicles, they can also cause it in the pelvis and abdomen, as has already been proven by the gynecologist.

ANALYSIS OF CASES

The data used in this paper were obtained from the x-ray files and the clinical histories of patients of the Stanford University Medical School. There were pelvic films of 900 patients, 286 or 31.7 per cent of whom showed phleboliths. Of this latter group 135 were private cases in which histories were not available and only an incomplete analysis could be made of the data given on the x-ray order slip. The other 151 cases came from the clinic where more or less complete histories were available. The average age was forty-nine and the youngest was twenty. Patients showing phleboliths *only* in their pelvic x-rays seemed to occur more frequently in the second and third decades. In the later decades there were more complications, particularly hypertrophic arthritis of the spine and genito-urinary disease in both male and female, to which the patients' complaints could be more likely attributed.

Of the 135 private cases which showed phleboliths, there were sixty-one sent in for x-ray of the pelvis, lumbar spines or sacro-iliac regions. Twenty-eight of these showed nothing in the x-rays but phleboliths, the other thirty-three showed in addition to the phleboliths, hypertrophic arthritis, old fractures of the pelvis and

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* Read before the Urology Section of the California Medical Association at the Fifty-Sixth Annual Session, April 25-28, 1927.